Abstract of the Disclosure

A differential diameter hole drilling method by which through-holes having improved major surface quality are formed in a target material involves drilling a pilot hole having a diameter that is less than the desired diameter of the through-hole and then drilling a through-hole having the desired diameter. The pilot hole forms a channel from which thermal energy produced during laser drilling can diffuse into the environment, thereby reducing the amount of thermal energy diffusing into the surrounding target material matrix and the degree of thermal damage to the heat affected zone of the target material matrix. The pilot hole also forms a channel through which ablated target material may be removed, thereby increasing overall through-hole throughput. Pilot hole formation reduces the thermal energy required to form the remaining portion of the through-hole and thereby results in less thermal damage to the surrounding target material matrix.